# ACUTE ILLNESS OBSERVATION SCALE (AIOS) IN COMMUNITY ACQUIRED PNEUMONIA IN CHILDREN AGED 2 MONTHS TO 59 MONTHS

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# CERTIFICATE

This is to certify that the dissertation titled **"ACUTE ILLNESS OBSERVATION SCALE (AIOS) IN COMMUNITY ACQUIRED PNEUMONIA IN CHILDREN AGED 2 MONTHS TO 59 MONTHS"** submitted by **Dr.ANOOP.K** to the Faculty of pediatrics, The Tamilnadu Dr. M.G.R. Medical university, Chennai in partial fulfillment of the requirement for the award of M.D. Degree (Pediatrics) is a bonafide research work carried out by him under our direct supervision and guidance.

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# DECLARATION

I **Dr. ANOOP. K.** solemnly declare that the dissertation titled **"ACUTE ILLNESS OBSERVATION SCALE (AIOS) IN COMMUNITY ACQUIRED PNEUMONIA IN CHILDREN AGED 2 MONTHS TO 59 MONTHS"** has been prepared by me.

This is submitted to **The Tamilnadu Dr. M.G.R. Medical University**, Chennai in partial fulfillment of the rules and regulations for the M.D. Degree Examination in Pediatrics.

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# CONTENTS

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# INTRODUCTION

Paediatric respiratory disease remains an important cause of morbidity in both the developing and the developed world. It has become the most common reason parents cite for taking their children to see the general practitioner, and for attendance to the emergency department with a paediatric medical problem[1].

Community acquired pneumonia (CAP) refers to an infection of the lung by a variety of microorganisms acquired outside the hospital setting, resulting in inflammation of the lung tissue. It is typically associated with fever and respiratory symptoms such as cough and tachypnoea, but symptoms may be non-specific in young children. Radiographic changes may be useful to confirm the diagnosis. It remains an important cause of death in children throughout the world, especially in developing countries. The groups at highest risk of long term morbidity and mortality include infants (especially low birth weight or premature), those who are immune compromised, and those who have other underlying conditions such as malnutrition or congenital heart disease.

Despite pneumonia being a condition commonly encountered by clinicians, uncertainty remains over the diagnosis, investigation, and

treatment of the condition. The British Thoracic Society (BTS) and WHO have published clinical guidelines which provide evidence base for the management of CAP[2]. The guidelines recognize, however, that there are still some recommendations based on consensus opinion due to the lack of available evidence.

**Epidemiology**

Acute respiratory infections (ARIs) continue to be the leading cause of acute illnesses worldwide and remain the most important cause of infant and young children mortality, accounting for about two million deaths each year [3,4,5]and ranking first among causes of disability-adjusted life-years (DALYs) lost in developing countries (94.6 millions, 6.3% of total)[6] . The populations most at risk for developing a fatal respiratory disease are the very young, the elderly, and the immune compromised. While upper respiratory infections (URIs) are very frequent but seldom life-threatening, lower respiratory infections (LRIs) are responsible for more severe illnesses such as influenza, pneumonia, tuberculosis, and bronchiolitis that are the leading contributors to ARIs' mortality[7] . Pneumonia, with a global burden of 5 000 childhood deaths every day, is a tangible threat that needs to be dealt with accordingly.

The incidence of ARIs in children aged less than 5 years is estimated to be 0.29 and 0.05 episodes per child-year in developing and industrialized countries, respectively, which translates into 151 million and 5 million new episodes each year, respectively[8]. Most cases occur in India (43 million), China (21 million), Pakistan (10 million), Bangladesh, Indonesia and Nigeria (56 million each). Pneumonia is responsible for about 21% of all deaths in children aged less than 5 years, leading to estimate that of every 1000 children born alive, 12-20 die from pneumonia before their fifth birthday[6]. The incidence of pneumonia in developed countries may be as low as 3-4%, its incidence in developing countries range between 20-30% this difference is due to high prevalence of malnutrition, LBW and indoor air pollution [9].

**Etiology**

CAP can be caused by a variety of organisms (table 1)[10-13]. Identification of the causative organism would direct treatment but accurate, fast, affordable, and widely available diagnostic tools are still awaited.

There is a current widely held belief that the causative organisms vary according to the age of the child, viruses being most common in children under 5 years old. Respiratory syncitial virus (RSV, most

common in the very young), adenovirus, parainfluenza virus, influenza virus, and more recently metapneumovirus[14] virus have all been identified in this age group.

**Table.1 causative pathogen among different age groups**

| Age | Common Cases | Less Common |
|---|---|---|
| birth to 20 days | **bacteria**<br>Escherichia coli<br>Group B Streptococci<br>Listeria monocytogen | **bacteria**<br>Anaerobic Organisms<br>Group D streptococci<br>Haemophilus influenza<br>Streptococcus pneumonia<br>Urea plasma ureolyticum<br>**viruses**<br>Cytomegalo virus<br>Herpes simplex. |
| 3weeks to 3 months | **bacteria**<br>Chlamydia trachomatis<br>S.Pneumoniae<br>**viruses**<br>Adenovirus<br>Influenza virus<br>Parainfluenzavirus 1,2,3<br>Respiratorysyncytialvirus. | **bacteria**<br>Bordetella pertusis<br>H.Influenzae<br>Moraxella catarrhalis<br>Staph.aurius<br>U.Urealyticum<br>**Viruses**<br>Cytomegalovirus |
| 4 months to 5 years | **Bacteria**<br>Chlamydia pneumonia<br>Mycoplasma pneumoniae<br>**Viruses**<br>Adenovirus<br>Influenza virus<br>Para influenza virus | **Bacteria**<br>H.Influenzae1<br>M.Catarrhalis.<br>M.tuberculosis<br>N. meningitis<br>S.aureus<br>**Viruses**<br>Varicella-Zoster |
| 5yrs to adolescence | Rhinovirus, RSV<br>**Bacteria**<br>C. Pneumoniae<br>M.Pneumoniae<br>S.Pneumoniae | **Bacteria**<br>H.Influenza<br>Legionella<br>M.tuberculosis<br>S.aureus<br>**Viruses**<br>Epstein-Barr virus<br>Para influenza<br>Rhinovirus |

Bacterial causes are reported as being more common in older children. Most etiology studies in the developed world from the last 15 years suggest that Streptococcus pneumoniae and mycoplasma account for most cases of bacterial pneumonia[15-20]; however, the number of cases attributable to these two organisms varies greatly between studies. The incidence of S pneumoniae varies from 4%[21] to 8%[15] to 21%[22]. Similar differences are seen for mycoplasma.

There are studies that support a preponderance of particular organisms in different age groups. For example, a Finnish study[23] found that in children younger than 5 years of age, the incidence of S pneumoniae infection was 8.6/1000 per year and mycoplasma 1.7/1000 per year. In children aged from 5–15 years, the incidence of S pneumoniae fell to 5.4/1000, while that of mycoplasma rose to 6.6/1000. However, the audit by Clark et al[24] did not support this finding; in their study the mean age of children with mycoplasma infection was 3.5 years. Apart from S pneumoniae and mycoplasma, other organisms that need to be considered include Chlamydia trachomatis, Bordetella pertussis, Staphylococcal aureus, and Mycobacterium tuberculosis.

## DIAGNOSIS

### Clinical presentation

Children and infants may present with a number of different clinical symptoms and signs such as fever, cough, and tachypnoea. A minority of children will present with pyrexia of unknown origin and may have no respiratory symptoms or signs.

The WHO has developed an algorithm[25] to aid medical and non-medical health care workers in diagnosing lower respiratory tract infection without radiological confirmation. This algorithm was designed for use in the developing countries but is still useful as a clinical tool in the UK. The WHO algorithm stresses the importance of tachypnoea (table 2) as an indicator of pneumonia. Studies from the developed world support this finding[26,27]. Palafox[26] found that tachypnoea (as defined by WHO) had a 74% sensitivity and 67% specificity for radiologically defined pneumonia. However, clinicians must be cautious in children who present early in the disease. In children who had the disease for less than three days[26], tachypnoea had a lower sensitivity and specificity of illness. Clinicians must be aware that the absence of tachypnoea does not necessarily mean the absence of pneumonia[27].

Tachypnoea as a sign of pneumonia must also be used with caution in children with co-morbid conditions such as asthma where tachypnoea is a sign of deterioration of the underlying condition; even when combined with a fever and cough it would not necessarily require the addition of an antibiotic.

The signs like grunting and nasal flaring increase the chance of pneumonia, but their absence cannot be relied upon to rule out pneumonia[26]. Other signs that relate to the severity of the pneumonia are chest in-drawing, nasal flaring, and cyanosis. Other noises such as rales, rhonchi, or crackles alone are not sensitive or specific for the diagnosis of pneumonia.

High fever in young children (aged up to 3 years) is also found to be a sign of pneumonia[28,29]. A temperature >38.5˚C is a feature of bacterial pneumonia[2]. The BTS guidelines have suggested that in children under 3 years old a combination of fever >38.5˚C, chest recession, and respiratory rate of more than 50 indicates pneumonia. Breathing difficulty itself is a more reliable sign in older children. The absence of clinical signs is more helpful to a clinician than their presence. If all clinical signs are negative, pneumonia is unlikely. However, if signs are present, they can be used in

combination to guide the clinician to consider a diagnosis of pneumonia but do not secure a definitive diagnosis.

**Table 2 WHO defined tachypnoea**

| | |
|---|---|
| < 2 months of age. | >60 breaths/min |
| 2–12 months | >50 breaths/min |
| >12 months | >40 breaths/min |

A child with mycoplasma infection may present with symptoms such as wheeze and cough, therefore mycoplasma infection should be considered in a patient with suspected asthma not responding to treatment. Mycoplasma may also present with abdominal pain or chest pain. Abdominal pain may also be caused by bacterial pneumonia owing to diaphragm irritation. It is one of the differential diagnoses in a child who presents with fever and abdominal pain, and can present to the surgeons as well as to paediatricians. Pneumonia needs to be excluded in infants presenting with pyrexia of unknown origin or a picture of generalized sepsis.

**Admission to hospital**

A child may be admitted to hospital if:

1. they are not tolerating oral medication due to vomiting, or
2. there are social concerns—for example, family unable to provide appropriate support, or
3. They have signs or symptoms of severe breathing difficulty.

Table 3 is a summary of recommendations[2,25,30] from the BTS, WHO, and Paediatric Accident and Emergency Research Group guidelines to help clinicians to identify which children may need to be admitted to hospital.

**Table 3 Indications for admissions to hospital**

| |
|---|
| Oxygen saturation >92% in air |
| RR >70/min in infants, >50/min in older children |
| Signs of severe breathing difficulty;<br>chest wall in-drawings, nasal flaring, grunting, apnea |
| Feeding less than half normal intake |
| Signs of dehydration |

**Serological diagnosis and other laboratory tests**

A variety of different laboratory tests are currently used in combination with clinical assessment to diagnose pneumonia. Indications for their use are discussed below.

The white blood cell count, C reactive protein (CRP), and erythrocyte sedimentation rate (ESR) have been used as markers of infection, but none of them have been shown to be helpful in distinguishing between bacterial, viral and a mixed pneumonia[31]. The routine measurement of acute phase reactants in the child with pneumonia is therefore not recommended[2].

Blood cultures are routinely taken in many hospitals, but they have a low yield for identification of the causal organism(s)[15,22]. In addition they take 2–3 days for a positive result and so are not helpful in informing initial antibiotic prescribing. It is not recommended that blood cultures are taken in the community setting, although within the hospital setting the BTS guidelines still recommend that they are performed[2].

Polymerase chain reaction (PCR) enhances the identification of the pneumococcal organism[15] and mycoplasma. PCR testing is expensive, not

widely available, and not rapid enough to affect initial management. The routine use of PCR is currently not recommended, but in the future may provide important evidence of specific etiology and guide treatment.

Mycoplasma pneumonia remains difficult to diagnose clinically and serologically, therefore treatment is often started empirically. Cold agglutinins seen in mycoplasma infection have been used during the acute phase but have limited value since the positive predictive value is only 70%[32].The gold standard remains paired serology 14 days apart. The BTS guidelines do not give clear recommendations of when serological tests for mycoplasma should be performed since most children are treated for the disease empirically based on the clinician's suspicion of the organism being present. Until more evidence is available it is useful for paired samples to be taken in children who are not responding to treatment.

Nasopharyngeal aspirate for viral immune fluorescence and viral antigen detection may be useful in identifying a virus but has little effect on the immediate management of a patient. These tests are highly sensitive and help to identify RSV positive children so that they can isolated, thereby avoiding infection of other children on the ward. The results of this test are also useful for epidemiological purposes, but it is important to be

aware that pneumonia may have a mixed etiology and may still require antibiotic treatment.

Table 4 provides a summary[2,30] from the BTS and the Paediatric Accident and Emergency Research Group guidelines of investigations useful for children admitted to hospital with suspected pneumonia based on current evidence.

**Table 4 Useful investigations in hospital**

| |
|---|
| Blood cultures if suspected to have bacterial pneumonia |
| Acute serum, and convalescent serum if no diagnosis made during acute illness |
| Nasopharyngeal aspirate in children ,18 months |
| If significant pleural fluid present, pleural aspiration |

**Radiological diagnosis**

The chest X ray (CXR) is still considered to be the gold standard for diagnosing pneumonia in the developed world. However, there is poor concordance between radiologists about what radiological changes constitute pneumonia. An additional problem is the variation in reporting CXRs between radiologists. Davies et al [33]studied the CXRs of 40 infants under the age of 6 months admitted with lower respiratory tract infection

and showed that there is variation in intra-observer and inter-observer agreement among radiologists. Others have confirmed this[34]. Consolidation on the CXR was most commonly identified by the radiologists and generally agreed to represent pneumonic change[33].

WHO has recognized the difficulties with CXR interpretation and developed a tool to standardize the reporting of CXR for use in epidemiological studies of pneumonia. This system classifies CXR as normal appearance, infiltrates or end stage consolidation defined as a ‘‘significant amount of alveolar type consolidation’’. So does a normal CXR rule out pneumonia? There is anecdotal evidence for having pneumonia with a normal CXR. Fever and tachypnoea may present before CXR changes are seen. How this is managed will depend on the individual case taking into account factors such as age and length of illness.

Can CXR be used to assess etiology? In an earlier section, the difficulty with serological diagnosis was highlighted. A similar difficulty arises in trying to use CXR to distinguish etiology. Swischuk[35] found a 90% accuracy rate overall when trying to differentiate bacterial from viral pneumonia. However, in this study cases were classed as being viral or bacterial on clinical grounds, a system which is known to be flawed. Bettenay[36] found that there was only a 30% chance of isolating a bacterium

when the CXR suggested a bacterial cause using the system designed by Swischuk. Thus, although consolidation is reliable for diagnosing pneumonia, it should not be used to assume a bacterial infection. This was further demonstrated in an etiology study by Virkki et al[37]. In this study, etiology and radiological changes were assessed in 254 children; only 72% of those with alveolar infiltrates had a bacterial infection. In children with solely viral pneumonia 50% had alveolar changes. Looking at the group with interstitial changes, half had evidence of viral infection and the other half had bacterial infection. This has been confirmed in a systematic review looking at the differentiation between viral and bacterial lower respiratory chest infection[38].

**When should CXR be performed?**

A systematic Cochrane review[38] indicates that there is no evidence to show that performing a CXR in ambulatory children (that is, children not admitted to hospital) aged over 2 months with an acute lower respiratory infection affects outcome and therefore it is not routinely necessary to perform CXR before treatment. In these children the clinician can use clinical signs and symptoms to direct management.

It is unclear which clinical signs should indicate the need for CXR. The available studies which examine the relation between clinical signs

and radiological changes give different results, but with the evidence available[39-42] the BTS[2] has concluded that ‘‘it is advisable to consider a CXR in a child <5 years with a fever of 39˚C of unknown origin unless classical features of bronchiolitis are present’’.

The contribution of CXR to management of children admitted to hospital with more severe symptoms is also not clear. CXRs have not been shown to alter management decisions or the time taken to recovery. CXRs are helpful when a complication such as pleural effusion is suspected, or pneumonia is prolonged or unresponsive to antimicrobials.

In summary, CXR is not helpful in determining etiology and does not contribute to the management of ambulatory children with mild uncomplicated lower respiratory tract illness. CXR to diagnose pneumonia may be helpful in some scenarios as detailed above. Table 5 provides some guidance[2] for clinicians as to which children would benefit from CXR. The guidance is not very specific because of the lack of research in this area.

**Table 5 Indications for CXR in either primary care or hospital**

| |
|---|
| For diagnosis of child <5 years with fever of 39˚C of unknown origin |
| If complication (for example, pleural effusion) suspected |
| Atypical symptoms or unresponsive to treatment |
| For follow up of children with lobar collapse or ongoing symptoms<br>For follow up of children with lobar collapse or ongoing symptoms |

## Treatment

The clinician faces four problems:

1. Whether to treat with antibiotics or not

2. If the decision is to treat, whether to use a narrow or broad spectrum antibiotic

3. Whether to administer the antibiotics via the oral or the intravenous route

4. Whether admission to hospital is required.

There has been only one study addressing the question of whether to treat or withhold antibiotics. Friis et al[43] conducted a prospective

randomized controlled trial allocating children with pneumonia to receiving either antibiotics or placebo. No difference was seen between the two groups in the course of the acute disease or with the development of pulmonary complications. However, 15 of the 64 children in the placebo group went on to receive antibiotics. On the basis of this study the BTS guidelines[2] suggest that young children (no age range given in the guidelines) presenting with mild symptoms of lower respiratory tract infection need not be treated with antibiotics. For all other children antibiotic treatment is warranted, but which antibiotic and by which route is by no means clear. Unfortunately, there exists a paucity of well conducted adequately powered randomized controlled trials comparing the effectiveness of different classes of antimicrobial agents in paediatric pneumonia.

Most children will be able to be treated using oral antibiotics in the community. Inpatient treatment is required if:

1. There are social concerns about the care of the child or concerns that the child will be given the antibiotics at home
2. The child is vomiting and either requires a trial of oral antibiotics in hospital or intravenous antibiotics if oral preparations are not tolerated

3. The child has signs of severe disease and requires supportive therapy—for example, oxygen
4. The child has severe disease and requires intravenous antibiotics
5. The child needs to be admitted to intensive care or high dependency.

**Which antibiotic?**

The choice of antibiotic is largely empirical, based on the most likely organism from etiology studies while also considering the age of the child. The most common cause of bacterial pneumonia is S pneumoniae. Resistance of S pneumoniae to penicillin is increasing but overall remains low. The BTS guidelines therefore suggest oral amoxicillin as first line treatment in children < 5 years, with co-amoxiclav, cefaclor, erythromycin, clarithromycin, and azithromycin as alternatives. Recommendations for the treatment of children >5 years are less clear. The true incidence of mycoplasma, even in the younger age group, is not known and varies widely in etiology studies, from 2% to 39%[44]. Therefore the use of macrolides either as first line treatment alone or in addition to penicillin poses a much more difficult question for the clinician. Studies comparing the use of macrolides with other groups of antibiotics as first line treatment have not been able to provide clear recommendations[45-47]. A clinical trial comparing antibiotic treatment options is required.

**Route of administration**

There have been no randomized controlled trials to investigate whether children admitted to hospital should be treated with oral or intravenous (IV) antibiotics. The BTS guidelines suggest that IV antibiotics should be reserved for children with severe symptoms or signs or those who are unable to tolerate oral antibiotics. In practice, however, many children deemed unwell enough to be admitted to hospital (for example, who are vomiting or requiring some oxygen) are treated with iv antibiotics irrespective of the severity of their signs or symptoms. The BTS guidelines initially stated that antibiotics administered orally are safe and effective for children presenting with CAP. Following appraisal by the quality of practice committee at the Royal College of Pediatrics and Child Health, this statement was amended to ‘‘amoxicillin administered orally is effective for children >6 months who are well enough to be treated without hospital admission’’. This is based on a trial comparing the efficacy of one dose of intramuscular penicillin to oral amoxicillin given to children in accident and emergency who were well enough to be discharged home[48]. Results of a multicentre randomized controlled trial comparing oral and IV treatment for children who require admission to hospital should be available later this year.

**Length of treatment**

There is currently little research to indicate the most appropriate length of time that a child with CAP should be treated with antibiotics. Oral antibiotics are routinely prescribed for 5–7 days, but treatment duration is increased to 10 days for severe infections (depending on which antibiotic is used). This practice is not based on clinical research and depends on the individual clinician. A multicentre randomized controlled trial has been completed in India[49], but this study only compared children with ‘‘non severe’’ pneumonia in the paediatric outpatient department and cases of pneumonia were based on a clinical diagnosis and not confirmed by CXR.

There are no randomized controlled trials in children addressing the issue about when to switch from intravenous antibiotics to oral antibiotics. If the child is clearly improving the clinician makes a judgment that it is safe to transfer to oral antibiotics[2]. Most often this is after 24 hours of intravenous treatment, when the temperature falls and symptoms of breathing difficulty are resolving.

## Complications

Most children with CAP improve without any sequelae. However, a small proportion develops complications which need treating. Table 6 provides a list of complications that may be encountered in children presenting with CAP.

**Table 6 Complications of CAP**

| |
|---|
| Treatment failure caused by antibiotic resistance |
| Pleural effusion and empyema |
| Lung abscess Septicemia |
| Metastatic infection—for example, osteomyelitis or septic arthritis |

## Follow up

Once the patient has been discharged from hospital, some clinicians arrange follow up X rays at 6–8 weeks. The value of this has been questioned and unless the child continues to be symptomatic or has lobar collapse or ‘‘round pneumonia’’, it is not recommended[50,51]

## Integrated management of neonatal and childhood illness (IMNCI)[52]

India being one of the countries with highest number of pneumonia deaths it is essential to optimize criteria for triage; early referral; hospitalization and commence treatment. This has been aided by the

IMNCI strategy that simplifies the classification of illness severity for major acute childhood illness including pneumonia. IMNCI was first developed in 1992 by UNICEF and the World Health Organization (WHO) with the aim of prevention, or early detection and treatment of the leading childhood killers

The IMNCI initiative adopted a broad, cross-cutting approach recognizing that in most cases; more than one underlying cause contributes to the illness of the child. A great deal has been learned from disease-specific control programs over the past 15 years. IMNCI attempts to combine the lessons learned into an effective approach for managing the sick child.

While the management of childhood illness focuses on treatment, it also provides the opportunity to emphasize prevention of illness through education on the importance of immunization, micronutrient supplementation, and improved nutrition – especially oral rehydration therapy (ORT), breastfeeding and infant feeding. IMNCI seeks to reduce childhood mortality and morbidity by improving family and community practices for the home management of illness, and improving case management of skills of health workers in the wider health system.

Key factors in the child's immediate environment – nutrition, hygiene, immunizations - are as important as medical treatment in

improving health. IMNCI is the umbrella through which all community health interventions can be delivered to the child.

**Process of IMNCI**[52]

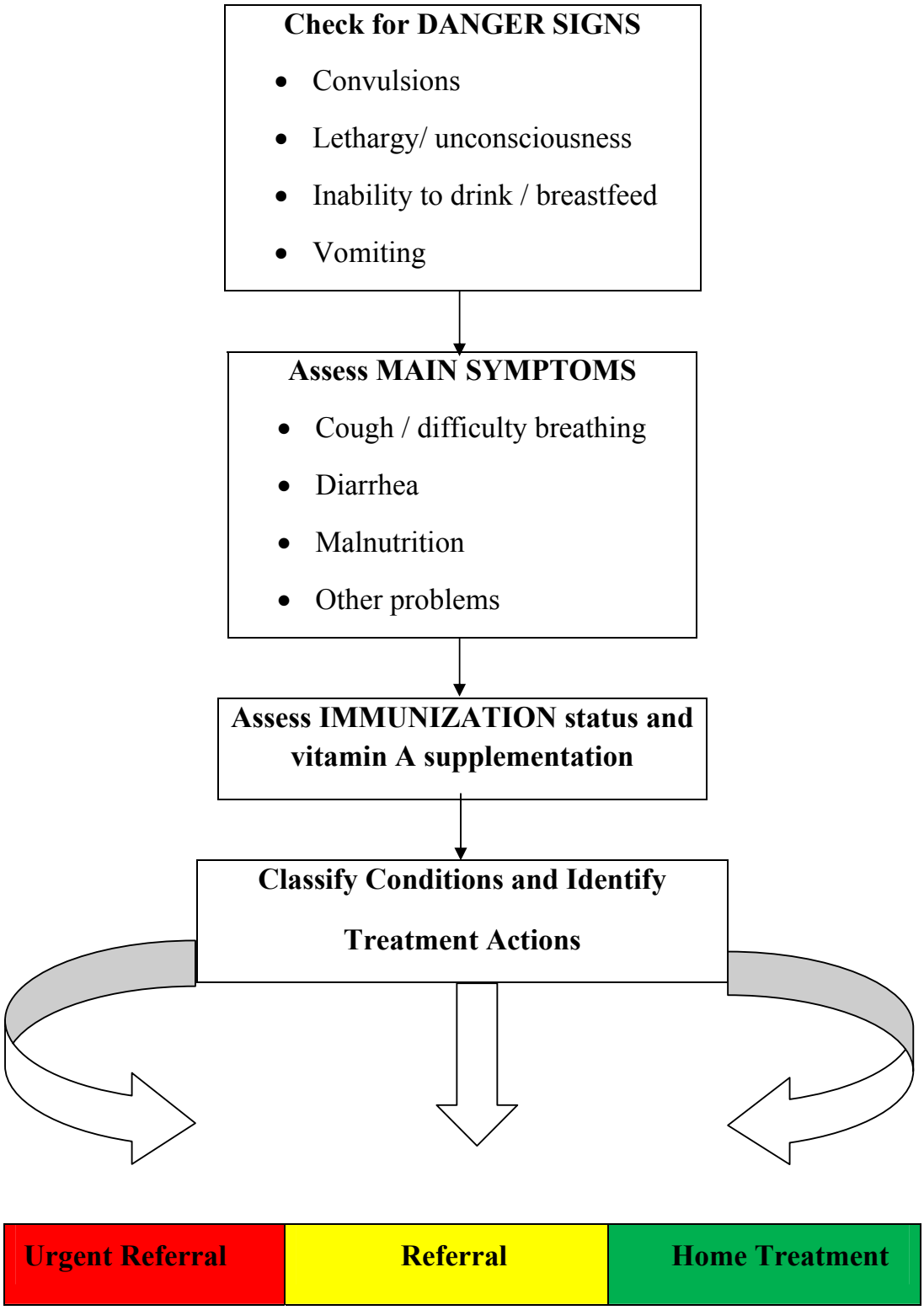
Integrated case management relies on case detection using simple clinical signs and research-based treatment. As few clinical signs as possible are used. The IMNCI process (see figure 1) includes three basic steps for every health topic included:

**Assess** a child through questions and observation. First the Community Health Worker checks for the presence of danger signs. Henceforth, s/he "evaluates" the presence of main symptoms related to cough/difficult breathing, diarrhea/dehydration, malaria, fever, ear infections and malnutrition. The following step includes the assessment of immunization status and vitamin A supplementation.

**Classify** the condition of the child using a color-coded triage system. Thus, **red color indicates urgent need for referral**; **the yellow color indicates referral**, and **green color, home-management and follow-up**.

Identify specific treatments for the child. Each treatment is determined in accordance to the color-coded classification and explained in detail in the clinical guidelines.

**Figure 1. Process of the management of cases in the IMNCI strategy for children of 2 months to 5 years old.**



For cough or difficult breathing in a child between 2 months to 5 years IMNCI assess, classify and decide treatment based on following table.

| SIGNS | CLASSIFY AS | IDENTIFY TREATMENT<br>(Urgent pre-referral treatments are in bold print) |
|---|---|---|
| Any general danger sign or<br>□ Chest in drawing or<br>□Strider in calm child. | **SEVERE PNEUMONIA OR VERY SEVERE DISEASE** | □***Give first dose of injectable chloramphenicol (If not possible give oral amoxicillin).***<br><br>□***Refer URGENTLY to hospital. #*** |
| Fast breathing | **PNEUMONIA** | □***Give Cotrimoxazole for 5 days.***<br><br>□Soothe the throat and relieve the cough with a safe remedy if child is 6 months or older.<br><br>□Advise mother when to return immediately.<br><br>□Follow-up in 2 days. |
| No signs of pneumonia Or very severe disease. | **NO PNEUMONIA: COUGH OR COLD** | □If coughing more than 30 days, refer for assessment.<br><br>□Soothe the throat and relieve the cough with a safe home remedy if child is 6 months or older.<br><br>□Advise mother when to return immediately.<br><br>□Follow-up in 5 days if not improving |

**Acute illness observation scale (AIOS)**

IMNCI strategy will be more effective in managing pneumonia when supplemented by an illness severity scoring system delivered in the

context to primary care setting that can quantity quickly the severity of illness at all stages from onset to recovery. In this regard use of AIOS- a genetic illness severity scale developed by P.L. McCarthy –represent a destructive paradigm drawing on simple observations(based on toxic appearance) instead of complex symptomatology, aiming for wholeness rather than details and encompassing the entire not just the ends of sickness continuum. AIOS is a three point scale for six ordinal variables and total score range from 6-30. It is a validated clinical index of quantifying risk of serious bacterial infection in children 36 months or younger presenting with febrile illnesses. AIOS focuses on six easily observed factors that, taken together, are a sensitive, indicator of serious illness children. Incidence of serious bacterial infection is less than 2-3% if a febrile child scores 10 or less; 26% if scores are between 11-15 and 92% if AIOS score is 16 or above.

**Acute illness observation scale[53]: composition and score description**

**Quality of Cry**

1. Strong cry with normal tone or contented and not crying
2. Whimpering or sobbing
3. Weak cry, moaning, or high-pitched cry

**Reaction to Parental Stimulation**

1. Cries briefly and then stops, or is contented and not crying
2. Cries off and on
3. Cries continually or hardly responds

**State Variation**

1. If awake, stays awake, or if asleep and then stimulated, awakens quickly
2. Closes eyes briefly when awake, or awakens with prolonged stimulation
3. Falls asleep or will not arouse

**Color**

1. Pink
2. Pale extremities or acrocyanosis
3. Pale, cyanotic, mottled or ashen

**Hydration**

1. Normal skin and eyes, moist mucous membranes
2. Normal skin and eyes, slightly dry mouth
3. Doughy or tented skin, dry mucous membranes and/or sunken eyes

**Response (Talk, Smile) to Social Overtures, Over 2 Months**

1. Smiles or alerts

2. Smiles briefly or alerts briefly

3. No smile, anxious face, dull expression, or does not alert

# AIM OF STUDY

To validate AIOS in predicting illness severity and clinical outcome of community acquired pneumonia

# LITERATURE REVIEW

## AIOS in predicting illness severity

1. In order to define valid and reliable observation data for judgment prior to history and physical examination McCarthy PL et al[54] did a study between Nov 1, 1980 and March 1, 1981, using a 14 scaled item which were scored simultaneously by attending physician, residents, and nurses prior to history and physical examination on 312 febrile children aged<=24 months seen consecutively in a Primary Care Center Emergency Room and in one private practice. Of these 312 children, 37 had serious illness. Multiple regression analysis based on patients seen by at least one attending physician in Primary Care Center revealed six items (quality of cry, reaction to parents, state variation, color, hydration status, and response to social overtures) that were significant and independent predictors of serious illness (multiple R = 0.63). The observed agreement between for these six items between two attending physicians who saw one third of the patients ranged from 88% to 97%. The chance corrected agreement level (kW) for these six items were with one exception, clinically significant (kW=0.47 to 0.73). A discriminate function analysis revealed that these six items when used together had a specificity of 88%

and sensitivity of 77% for serious illness. Individual scores for each of the six key items were added to yield a total score for each patient. Only 2.7% of patients with a scores ≤ 10 had a serious illness, 92.3% with a score ≥16 had a serious illness. The sensitivity of the six-item model for serious illness when combined with history and physical examination was 92%. In the population studied, this predictive model, when used prior and physical examination, was reliable predictive, specific, and sensitive for serious illness in febrile children. It was most sensitive when combined with history and physical examination. The model wifi need to be validated on a new population of patients.

2. To determine if observational assessment performed in a systematic manner adds to the efficacy of the traditional history and physical examination in detecting serious illness in febrile children, and to determine the sensitivity of the combined evaluation, McCarthy PL et al[55] in 1982 studied consecutive patients < 24 months of age seen for evaluation of fever. The study showed that combined AIOS, history, and physical examination had a higher sensitivity and re correlation for serious illness than did the traditional history and physical examination. Three children with serious illness, all of whom had no abnormalities on history and physical examination, were identified only by use of AIOS.

3. In the perspective of IMNCI Strategy and recent evidence favoring use of oral antibiotics in severe pneumonia with an objective of validating AIOS in severe pneumonia a study was done at a civil hospital in remote hilly region of shimla district of Himachal Pradesh by Bharathi Bhavaneet et al[56] which showed that children scoring abnormally on AIOS (>10) had significantly higher frequency of severe tachypnea (P>0.01), marked recession (P>05), and grunting (P-0.01) while frequency of inability to drink reached statistical significance (P<0.05) only for children who scored 16 on AIOS.

**AIOS in determining clinical outcome**

The study[56] done in shimla district of Himachal Pradesh showed that higher the scores on AIOS, longer it took for tachypnea to decrease (P<01), as well as subside (P-01) and hospital stay was also prolonged (P<01). Although not significant, scores also tended to positively correlate with time taken for fever to settle (P<10)

**AIOS correlation between physician and mothers**

A study was done by Paul L. McCarthy MD[57], Domenic V et al from The Departments of Pediatrics and psychiatry, Yale University School of

Medicine in 1991. The purpose of this study was to investigate to what extent selected adverse demographic, clinical, and psychosocial data measured at the 2-week well child visit could predict poorer reliability of mothers' judgments during acute illness episodes over the next 32 months. The study was a randomized trial of the Acute Illness Observation Scales (AIOS); 369 mothers participated, 183 in the intervention group using the Acute Illness Observation Scales and 186 in the control group using a three-point global assessment scale. There were 704 acute illnesses judged simultaneously and independently by mothers and pediatricians. Standard Pearson *r* correlations were performed between the independent variables, taken singly and in all possible combinations, and the dependent variable, reliability of mothers' judgments as measured by weighted kappa (*k*w). Group assignment was entered as an independent variable. Analyses were performed separately for all first, second, and third acute illness visits to control for any "practice effect" (analysis 1). To control for consistency of observers, the first, second, and third visits of mothers with three visits were also analyzed (analysis 2). Depending on the visit number, adverse demographic, clinical, and psychosocial characteristics did correlate with poorer reliability independent of group assignment. The correlations ranged from small (analysis 1, first visit, multiple variable $r^2 = 4\%$) to large (analysis 2, second visit, multiple variable $r^2 = 29\%$). Controlling for both

visit number and consistency of observers vs visit number alone (analysis 2 vs analysis 1) increased multivariate correlations to *k*W. The results support the untoward impact that adverse demographic, clinical, and psychosocial factors have on mothers' clinical judgment. These data may assist pediatricians in identifying parents who might benefit from more intensive teaching and support about acute illness episodes in their children

**Spectrum of clinical features and management of community acquired pneumonia**

To describe the spectrum of clinical features and management of community acquired pneumonia in the UK a study was done by Clark JE, Hammal D, Spencer D, Hampton F[58] from the Department of Paediatric Infectious Disease, Newcastle General Hospital, Newcastle, UK. They prospectively recorded clinical details for all children with possible pneumonia and chest X ray (CXR) changes in 13 hospitals in the North of England between 2001 and 2002. 89% of 711 children presenting to hospital with pneumonia were admitted; 96% received antibiotics, 70% intravenously. 20% had lobar CXR changes, 3% empyema and 4% required intensive care. Respiratory rate (RR), hypoxia and dyspnoea all correlated with each other and prompted appropriate interventions. Admission in children, not infants, was independently associated with RR,

oxygen saturation, lobar CXR changes and pyrexia. Neither C-reactive protein, lobar CXR changes or pyrexia were associated with severity. Children over 1 year old with perihilar CXR changes more often had severe disease ($p = 0.001$). Initial intravenous antibiotics were associated with lobar CXR changes in infants and children and with dyspnoea, pyrexia and pleural effusion in children. The presence of pleural effusion increased duration of antibiotic treatment ($p<0.001$). Cefuroxime was the most often used intravenous antibiotic in 61%. Oral antibiotics included a penicillin in 258 (46%), a macrolide in 192 (34%) and a cephalosporin in 117 (21%). Infants stayed significantly longer ($p<0.001$) as did children with severe disease ($p<0.01$), effusions ($p = 0.005$) or lobar CXR changes ($p<$ or $=0.001$).

**Hypoxemia in pneumonia**.

1. Since oxygen has to be given to most children in developing countries on the basis of clinical signs without performing blood gas analyses, possible clinical predictors of hypoxemia were studied by M. Weber, S. Usen, A. Palmer, S. Jaffar[59], and E Mulholland Medical Research Council Laboratories, Fajara, The Gambia in 1996. Sixty nine children between the ages of 2 months and 5 years admitted to hospital with acute lower respiratory tract infection and an oxygen saturation

($SaO_2$) < 90% were compared with 67 children matched for age and diagnosis from the same referral hospital with an $SaO_2$ of 90% or above (control group 1), and 44unreferred children admitted to a secondary care hospital with acute lower respiratory infection (control group 2). Using multiple logistic regression analysis, sleepiness, arousal, quality of cry, cyanosis, head nodding, decreased air entry, nasal flaring, and upper arm circumference were found to be independent predictors of hypoxemia on comparison of the cases with control group 1.Using a simple model of cyanosis or head nodding or not crying, the sensitivity to predict hypoxemia was 59%, and the specificity 94% and 93% compared to control groups 1 and 2, respectively; 80% of the children with an $SaO_2$ < 80% were identified by the combination of these signs. Over half of the children with hypoxemia could be identified with a combination of three signs: extreme respiratory distress, cyanosis, and severely compromised general status. Further prospective validation of this model with other datasets is warranted. No other signs improved the sensitivity without compromising specificity. If a higher sensitivity is required, pulse oximetry has to be used.

2. Another study was done by Sudha Basnet, Ramesh Kant Adhikari and Chitra Kumar Gurung[60] from Department of Pediatrics, Department of

Community Medicine and Family Health, EPC 376, Kathmandu, Nepal with an objective to assess the prevalence of hypoxemia in children, 2 months to 5 years of age, with pneumonia and to identify its clinical predictors Patients were categorized into groups: cough and cold, pneumonia, severe pneumonia and very severe pneumonia. Hypoxemia was defined as an arterial oxygen saturation of <90% recorded by a portable pulse ox meter. The prevalence of hypoxemia ($SpO_2$ of <90%) in 150 children with pneumonia was 38.7%. Of them 100% of very severe pneumonia, 80% of severe and 17% of pneumonia patients were hypoxic. Number of infants with respiratory illness (p value=0.03) and hypoxemia (Odds ratio=2.21, 95% Cl 1.03, 4.76) was significantly higher. Clinical predictors significantly associated with hypoxemia on univariate analysis were lethargy, grunting, nasal flaring, cyanosis, and complaint of inability to breastfeed/drink. Chest in drawing with 68.9% sensitivity and 82.6% specificity was the best predictor of hypoxemia.

**Antibiotics in pneumonia[61]**

1. The studies includes randomized controlled trials (RCTs) and quasi – RCTs comparing the two ways of giving antibiotics in the treatment of pneumonia.

2. Only three studies met all criteria for eligibility and 29 were rejected.

3. Campbell 1988 compared oral cotrimoxazole versus intramuscular penicillin followed by an oral antibiotic in 134 children. There was similar recovery in both groups at follow up.

4. APPIS Group 2004 evaluated 1702 patients, comparing oral amoxicillin, against intravenous penicillin for two days. They showed equivalence in effectiveness and safety in both treatments.

5. Oral therapy appears to be an effective and safe alternative to parenteral antibiotics in hospitalized children with severe pneumonia who do not have any serious signs or symptoms

6. There is currently insufficient evidence to determine the relative benefits and harms of oral antibiotics in children with severe pneumonia if serious signs and symptoms are present or in children with severe pneumonia associated with bacterial conformation or lobar consolidation of chest X-ray.

**Illness severity in community acquired pneumonia**

For assessing illness severity in CAP in children there are no studies available in the literature, but for adults there are scoring systems for the same. For adults The Pneumonia Severity Index has been useful in assessing community-acquired pneumonia (CAP) and will continue to be.

However, two other CAP evaluation tools, the CURB-65 score and its relative the CRB-65 score, were recently validated.[1]

CURB-65, as many pulmonologists know, is an acronym for Confusion, Urea (greater than 7 $mmol \cdot L^{-1}$), Respiratory rate ($30 \cdot min^{-1}$ or greater), low Blood pressure, and an age of 65 or older. "The current study demonstrates a significant correlation between the CURB-65 score and the risk of 30-day mortality, need for mechanical ventilation, and rate of hospital admission," related the authors. "Among hospitalized patients, the CURB-65 score was significantly associated with duration of hospital stay."

The results were similar for the even simpler CRB-65 score, the authors also reported; they pointed out that a urea measurement was omitted from that score.

# STUDY JUSTIFICATION

Gaining an objective understanding of well being of a child with pneumonia is essential to optimize criteria for triage, early referral, hospitalization and deciding on initial therapeutic modalities in less developed countries. This has been aided by IMCI strategy that simplifies the classification of illness severity for major acute childhood illness including pneumonia.

Several studies has been conducted in India to measure the effectiveness of IMCI and showed IMCI to be an effective strategy for case management in acute childhood illness. IMCI strategy will be more effective in managing pneumonia when supplemented by an illness severity scoring system delivered in the context to primary care setting that can quantity quickly the severity of illness at all stages from onset to recovery. This need has been augmented by the recent evidence favoring oral antibiotics in treatment of severe community acquired pneumonia.

An objective and graded appraisal of “Clinical appearance” easily ascertained by primary care givers can be instrumental in influencing the subsequent decision. In this regard use of AIOS- a genetic illness severity

scale developed by P.L. McCarthy –represent a destructive paradigm drawing on simple observations. AIOS focuses on six easily observed factors that, taken together, are a sensitive, indicator of serious illness in children.

All the three components of care envisaged in IMCI strategy can be upgraded by the use of AIOS. Firstly, the evidence based syndromic approach lays significant emphasis on evaluating the severity of child's condition by primary care workers who usually misclassify symptoms with overlapping causes or for which a single diagnosis using earlier vertical disease WHO algorithm, AIOS seems to fulfill this role in simple and objective manner. In a series of articles beginning in 1980 McCarthy et al ad already demonstrated the utility of AIO children who have the most toxic illness and those who have serious illness (e.g. pneumonia, UTI, meningitis, severe gastroenteritis, a focal complication etc.). AIOS offers an explicit, objective, and actionable easily implemented in real world practice.

Second, the in hospital curative services also can be rationed by use of AIOS which might safely increase the proportion of children with severe community acquired pneumonia that can be treated as outpatient with oral antibiotics

Lastly AIOS can boost skills of mother to identify sickness of a child at home. In this regard, a randomized trial aimed at educating parents about the use of AIOS had demonstrated that its use results in more reliable parent judgment about well being of children during acute illness.

Many studies have been done to demonstrate the utility of AIOS in detecting serious illness in febrile children. Studies criticizing AIOS were mainly restricted to babies below 8 weeks of age and those with occult bacterimia in non-toxic children. There is only one study done in Himachal Pradesh, India showing utility of AIOS in severe pneumonia. So there is a need to do such type of studies in a larger population in southern parts of the country like Tamil Nadu

# METHODOLOGY

**Study design**

Descriptive study of a cohort of children

**Study period**

September 2007- September2009

**Study population**

Children aged 2 to 59 months

**Study setting**

**Institute of Child health and Hospital for Children, Madras Medical College**, Egmore, Chennai, Tamilnadu, a tertiary care hospital

**Sample size**

Proportion of children with severe illness (AIOS>10) =20% With precision 5% and alpha 5% sample size is calculated as 246.

**Inclusion criteria**

Children between 2 months –59 months presenting with Fever less than 3 days with cough or difficult breathing with any of the following:

1. Fast breathing

   2 Months –12 months >50/mt

12 Months –5 years >40/mt

2 Chest in drawing

3 Strider in calm child

4 grunting

5 Lethargy

6 Convulsion

7 Inability to drink

**Exclusion criteria**

1. Duration of illness >2 weeks

2. Respiratory distress with prominent wheezing

**Procedure /maneuver**

1. Children between 2 months –59 months coming to OP with suspected pneumonia, if satisfying the inclusion criteria were enrolled into the study group and admitted or given treatment as OPD based on illness severity as assessed by IMNCI classification or as the physician decides.

2. Get parental consent.

3. AIOS scoring is done on each subject on day 1, day 2, day 5 by two persons simultaneously in a reasonably quite state.

4. Pulse oxy meter reading of each patient is recorded.

5. Respiratory parameters and vital signs as in data collection form are documented

6. Chest X ray, complete blood count, blood culture and urine culture were done with in 24 hrs of admission.

7. Chest X ray was interpreted by a radiologist who was blinded about the study based on WHO guide lines for interpretation of X rays in paediatric pneumonia

8. Treatment, investigations and the disease course as per data collection form are documented.

9. Follow up until discharge or death

# RESULTS

248 children who met with inclusion criteria were enrolled in to the study. Statistical analysis was done using computerized soft ware and results are presented as follows

a) General characteristics

   1. Demographic characteristics
   2. Clinical features
   3. Investigations
   4. Treatment and course of the illness

b) AIOS and its clinimetrics

   1. Inter observer variability
   2. Score distribution in study population
   3. Individual item analysis
   4. Inter item correlation
   5. Construct validity
   6. Concurrent validity
   7. Correlation with physical signs

8. Correlation with pulse oxymetre reading

9. Correlation with investigations

10. Correlation with therapeutic decision

c) Comparison of AIOS with IMNCI

1. Assessment of illness severity

2. Prediction of clinical outcome

**a) General characteristics**

**1. Demographic characteristics**

- **Age and sex**:

The age in the study group ranged from 2months to 59 months (mean, 13.38 months; SD=11.2); and infants (2-12 months) (57.3%) being most affected. Among the 248 children 159 (64.1%) were males and the remaining being females with a male to female ratio of 1.7:1

**Table.1 age and sex distribution**

| | | n | % |
|---|---|---|---|
| age | 2-12 months | 142 | 57.3 |
| | 12-36 months | 95 | 38.3 |
| | >36 months | 11 | 4.4 |
| sex | male | 159 | 64.1 |
| | female | 89 | 35.9 |

- **Nutritional status**

Majority of children, 47.2% (117/248) were below 3rd centile as per WHO weight for age chart while 0.8% was above 97th percentile

**Table.2 weight for age percentile distribution**

| Weight for age centiles | n | % |
|---|---|---|
| <3rd | 117 | 47.2 |
| 3-15th | 59 | 23.8 |
| 15-50th | 42 | 16.9 |
| 50-85th | 27 | 10.6 |
| 85-97th | 1 | 0.4 |
| >97th | 2 | 0.8 |

**2. clinical features**

- **Symptoms**

All the children presented with complaints of fever and cough while history of rapid and difficult breathing was obtained in 98% of cases. The mean duration and standard deviation of most common presenting complaints are given below

**Table.3 common symptoms and duration**

| Symptoms | Mean duration(days) | SD |
|---|---|---|
| fever | 2.44 | 1.44 |
| cough | 2.84 | 1.60 |
| breathlessness | 1.66 | 1.25 |

Regarding danger symptoms, majority had lethargy (25%) while convulsion (4%) and grunt (5.6%) was least common.

**Table.4 danger signs in study population**

| symptom | n | % |
|---|---|---|
| convulsion | 10 | 4 |
| Inability to drink | 37 | 14.9 |
| lethargy | 62 | 25 |
| grunt | 14 | 5.6 |

- **Signs**

Vital signs like respiratory rate had a mean of 54.3(SD-9.9) while temperature and heart rate had a mean of 37.9 and 134.2 respectively.

**Table.5 vital signs distribution**

| Signs | Mean | SD |
|---|---|---|
| respiratory rate/mt | 54.31 | 9.98 |
| Temperature($^0$C) | 37.93 | 0.66 |
| Heart rate/mt | 134.19 | 24.53 |
| Systolic BP(mmHg) | 93.93 | 9.73 |
| Diastolic BP(mmHg) | 56.92 | 8.23 |

Regarding other respiratory morbidity signs majority had a respiratory rate between 51-60(48.38%) and retraction was mild-moderate in 53.65% and severe in 32.6%. percentage of children with grunting(6.4%) and cyanosis (2.4%) was very less, like wise was those

with abnormal capillary refill time(12.1%). Frequency of other respiratory signs in the affected children is shown in the following table

**Table.6 respiratory morbidity distribution**

| Signs | | Total | % |
|---|---|---|---|
| Respiratory rate/mt | 40 -50 | 78 | 31.4 |
| | 51 -60 | 120 | 48.38 |
| | >60 | 50 | 20.16 |
| Intercostal recession | | 111 | 44.75 |
| Sub costal recession | Mild-moderate | 133 | 53.6 |
| | severe | 81 | 32.66 |
| Grunt | | 16 | 6.4 |
| Cyanosis | | 6 | 2.4 |
| Lethargy | | 65 | 26.2 |
| Convulsion | | 10 | 4 |
| inability to drink | | 37 | 14.9 |
| Abnormal Capillary refill time (>2 sec) | | 30 | 12.1 |
| Decreased Breath sounds | | 11 | 4.5 |
| Bronchial breathing | | 14 | 5.6 |
| Crepitations | | 225 | 90.7 |
| Wheeze | | 96 | 38.7 |
| Vocal resonance | Decreased | 6 | 2.4 |
| | increased | 6 | 2.4 |

## 3. Investigations

- **Pulse oxymetry**

Pulse oxymetre recording was taken in all children on days 1, 2 and 5. A reading below 85%, which is associated with central cyanosis, was

observed in 5.6% (14/248) of cases. Spo2 recording of >92 was seen in 54.4% (135/248) and the remaining being in between. The average pulse oxymetre value on day 1 in the study sample was 92.9(SD-5.10)

**Table.7 SpO2 reading in study population**

| SpO2(%) | N | % |
|---|---|---|
| <85 | 14 | 5.6 |
| 85-92 | 99 | 39.9 |
| >92 | 135 | 54.4 |
| total | 248 | 100 |

- **Chest X ray**

Chest X-ray evaluation was done in all patients at admission. Normal CXR finding were present in 46% (114/248) and remaining 54% (134/248) had significant abnormalities. Among the X-ray abnormalities end point consolidation (include dense opacity that may be a fluffy consolidation of a portion or whole of a lobe or of the entire lung, often containing air bronchogram and sometimes associated with pleural effusion) was seen in 39.8% while other non end point infiltrates (defined as linear and patchy densities featuring peribronchial thickening and multiple areas of atelectasis)

**Table.8 chest X ray findings in study population**

| investigation | | n | % |
|---|---|---|---|
| CXR | abnormal | 134 | 54 |
| | normal | 114 | 46 |
| finding | End point consolidation | 53 | 39.8 |
| | infiltrates | 80 | 60.2 |

- **Other investigations**

Among other investigations, leucocytosis was seen in 13.7% (34/248), a positive urine culture in 12.1% (30/248) and a positive blood culture in 13.7% (34/248) of cases.

**Table.9 blood and urine investigations in study population**

| Investigation | n | % |
|---|---|---|
| Leucocytosis | 34 | 13.7 |
| Positive Blood culture | 34 | 13.7 |
| Positive Urine culture | 30 | 12.1 |

**4. Treatment and course of the illness**

During their management 8.5% (21/248)of children were so severely affected that they needed normal saline boluses to correct the shock and 7.7%(19/248)needed ionotropic support with dopamine or dobutamine. Airway intubation was needed in2.8% (7/248) of cases either for respiratory failure or shock management. Oxygen was administered for

32.3% (80) of cases in view of severe respiratory distress or cyanosis. 28.6 %( 71/248) of children required maintenance i.v fluids because of severe respiratory distress and/or dehydration. Parenteral antibiotics were administered to 50.4% (125/248) patients while remaining were treated with oral antimicrobials. Presence of wheeze necessitated salbutamol nebulization in 25.4% (63/248) of cases. During the hospital stay 9.7% (24/248) developed complications either in the form of shock, empyema or pyopneumothorax. 5 children (2%) expired even after intensive care management. The mean duration of hospital stay (±SD) was 4.58(±4.94) days.

**Table.10 treatment and course of the illness**

| **Treatment and course of illness** | | **n** | **%** |
|---|---|---|---|
| antibiotic | oral | 123 | 49.6 |
| | Intra venous | 125 | 50.4 |
| IV fluids | | 71 | 28.6 |
| Received Fluid bolus | | 21 | 8.5 |
| inotropic support | | 19 | 7.7 |
| oxygen | | 80 | 32.3 |
| ventilation | | 7 | 2.8 |
| nebulisation | | 63 | 24.4 |
| Intercostal drainage | | 9 | 3.6 |
| decortications | | 3 | 1.2 |
| complication | Septic shock | 16 | 6.5 |
| | empyema | 5 | 2.0 |
| | Pyopneumo thorax | 3 | 1.2 |
| Hospital stay | <5 days | 191 | 77.0 |
| | 6-14 days | 42 | 16.9 |
| | >14 days | 15 | 6.0 |
| Final outcome | discharged | 245 | 98.0 |
| | died | 5 | 2.0 |

**b) AIOS and its clinimetrics**

Acute illness observation scale (AIOS) is a generic illness severity scale developed by P.L. McCarthy. AIOS is a three point scale for six ordinal variables and total score range from 6-30. The composition and scoring pattern of AIOS scale with its clinical significance are presented in table

**Table.11: Acute illness observation scale: composition, score description**

| Scale used | Acute illness observation scale |
|---|---|
| Items included | Quality of cry<br>Response to parent stimulation<br>State variation<br>Color<br>Hydration<br>Response to social overtures |
| Score interpretation | Each item scored as normal(=1)<br>Moderate(=3)and severe<br>Impairment(=5) |
| Total score | 6= best score<br>30= worst physical score |
| Chance of serious illness | Score≤10 : 2-3%<br>Score 11-15 : 26%<br>Score ≥16 : 92% |

**1. Inter observer variability**

Inter observer variability in AIOS scoring simultaneously between 2 observers was analyzed using Karl Pearson coefficient and was found be having very good positive correlation. For further analysis first investigator's observations were taken in to account.

**Table.12 inter observer correlation**

| | correlation | Karl Pearson correlation coefficient | interpretation |
|---|---|---|---|
| Day 1 | Inter observer | R=0.98 | Very good correlation |
| Day 2 | Inter observer | R= 0.85 | Very good correlation |
| Day 5 | Inter observer | R=0.84 | Very good correlation |

## 2. Score distribution in study population

40% of children with community acquired pneumonia scored abnormally (AIOS>10) at initial evaluation. Mean score for AIOS 12.32(SD-6.12) clearly signifies the seriousness of all children enrolled in the study. The frequencies of abnormal AIOS scores as well as mean total scores for different age groups are depicted below

**Table.13 score distribution in study population**

| age | AIOS on day 1 | | | | | |
|---|---|---|---|---|---|---|
| | ≤10 | | 11-15 | | ≥16 | |
| | n | % | n | % | n | % |
| 2-12 months | 77 | 54.2 | 27 | 19 | 38 | 26.8 |
| 12- 36 m0nths | 65 | 68.4 | 14 | 14.7 | 16 | 16.8 |
| >36 months | 7 | 63.6 | 0 | | 4 | 36.4 |

**$\chi 2=7.68$ P=0.16**

## 3. Individual item analysis

In the individual item analysis of AIOS, 89.3% and 80.2% of affected children scored normally for the variables “color” and “hydration

status" respectively. In contrast majority of children showed worst score in the variable "response to social overtures**.** For each of the variable the percentage of normal score and abnormal score are given below

**Table.14 score distribution of each items**

| item | normal score(=1) %(n) | Abnormal score(=3or5) %(n) |
|---|---|---|
| Quality of cry | 58.9%(146) | 41.1%(102) |
| Response to parent stimulation | 38.7%(96) | 61.3%(152) |
| State variation | 66.5%(165) | 33.5%(83) |
| color | 89.3%(223) | 10.7(25) |
| hydration | 80.2%(199) | 19.8%(49) |
| Response to social overtures | 16.9%(42) | 83.1%(206) |

## 4. Inter item correlation

Scales were assessed for their inter item correlation and overall Cronbach's α. Cronbach's α for AIOS was 0.91(an alpha of 0.70 is the minimum desirable level) indicating the homogeneity of scale variable in assessing illness severity in our study sample. Over all, the individual item analysis of AIOS revealed either similar or decreased values for α if item deleted, indicating that each item added unique information to total score.

**Table.15 cronbach's alpha of inter item correlation**

| | |
|---|---|
| Cronbach's alpha (α) | 0.91 |
| Children with best score n, (%) | 32, (12.9%) |
| Children with worst score n,(%) | 1, (0.4%) |

## 5. Construct validity

Total score on AIOS showed good correlation (Pearson) with selected clinical characteristics' at admission like grade of fever ($p<.001$), heart rate ($p<0.001$), respiratory rate ($p<0.001$).

**Table.16 Karl Pearson correlation of AIOS with selected clinical parameters**

| variable | Karl Pearson correlation | P value | interpretation |
|---|---|---|---|
| Temperature | R=0.63 | P=0.001 | Good correlation |
| Respiratory rate | R=0.64 | P=0.001 | Good correlation |
| Heart rate | R=0.64 | P=0.001 | Good correlation |

## 6. Concurrent validity

Relating children's score against their radiologic finding to assess the concurrent validity, 74.6% (85/114)children with normal CXR had AIOS of ≤10 whereas only 47.8%(64/) had normal scores in the group of abnormal CXR finding($\chi 2=29.1$ P=0.001). On the other hand, severity of respiratory distress was similar between children with normal and abnormal chest radiographs.

**Table.17 AIOS correlation with chest X ray**

| Chest X-ray | AIOS score on day 1 | | | | | |
|---|---|---|---|---|---|---|
| | ≤10 | | 11-15 | | ≥16 | |
| | n | % | n | % | n | % |
| abnormal | 64 | 47.8 | 21 | 15.7 | 49 | 36.6 |
| normal | 85 | 74.6 | 20 | 17.5 | 9 | 7.9 |

**$\chi 2=29.1$ P=0.001**

## 7. AIOS score and physical signs in pneumonia

Respiratory morbidity of affected children were also stratified by their illness severity scores at presentation. Children scoring abnormally on AIOS (>10) had significantly higher frequency of severe tachypnea (p=0.001), marked recession (p=0.001), grunting, cyanosis (p=0.01), lethargy, inability to drink and so on except incidence of convulsion and wheeze which didn't have any statistical significance

**Table.18 univariate analysis of AIOS with respiratory morbidity signs**

| | | AIOS_Day1 | | | | | | Total | Chi square test |
|---|---|---|---|---|---|---|---|---|---|
| | | <=10 | | 11-15 | | >15 | | | |
| | | n | % | n | % | n | % | | |
| Respiratory rate/mt | 40 -50 | 67 | 85.9% | 8 | 10.3% | 3 | 3.8% | 78 | χ2=56.0 P=0.001 |
| | 51 -60 | 67 | 55.8% | 26 | 21.7% | 27 | 22.5% | 120 | |
| | >60 | 15 | 30.0% | 7 | 14.0% | 28 | 56.0% | 50 | |
| Intercostal recession | | 35 | 31.5% | 22 | 19.8% | 54 | 48.6% | 111 | χ2=83.4 P=0.001 |
| Sub costal recession | Mild-moderate | 102 | 76.7% | 25 | 18.8% | 6 | 4.5% | 133 | χ2=111.1 P=0.001 |
| | severe | 16 | 19.8% | 16 | 19.8% | 49 | 60.5% | 81 | |
| Grunt | | | | | | 16 | 100.0% | 16 | χ2=56.2 P=0.001 |
| Cyanosis | | 1 | 16.7% | | | 5 | 83.3% | 6 | χ2=12.3 P=0.01 |
| Lethargy | | 8 | 12.3% | 10 | 15.4% | 47 | 72.3% | 65 | χ2=123.3 P=0.001 |
| Convulsion | | 4 | 40.0% | 1 | 10.0% | 5 | 50.0% | 10 | χ2=4.1 P=0.13NS |
| inability to drink | | 1 | 2.7% | 3 | 8.1% | 33 | 89.2% | 37 | χ2=106.2 P=0.001 |
| Abnormal Capillary refill time(>2 sec) | | 2 | 6.7% | | | 28 | 93.3% | 30 | χ2=93.2 P=0.001 |
| Decreased breath sounds | | | | 4 | 36.4% | 7 | 63.6% | 11 | χ2=17.6 P=0.001 |
| Bronchial breathing | | | | 3 | 21.4% | 11 | 78.6% | 14 | χ2=28.5 P=0.001 |
| Crepitations | | 126 | 56.0% | 41 | 18.2% | 58 | 25.8% | 225 | χ2=16.8 P=0.001 |
| Wheeze | | 52 | 54.2% | 21 | 21.9% | 23 | 24.0% | 96 | χ2=3.6 P=0.16 NS |
| Vocal resonance | Decreased | 1 | 16.7% | 2 | 33.3% | 3 | 50.0% | 6 | χ2=25.3 P=0.001 |
| | increased | | | | | 6 | 100.0% | 6 | |

## 8. AIOS and pulse oxymetre correlation

Relating children's score against their pulse ox meter recording on admission, severe hypoxemia associated with cyanosis (SpO2<85) was observed in 14 children of which 92.9% (13) scored a high value on AIOS (AIOS>15) whereas 81.5% of children scored normally on AIOS among the group of 135 with a spo2>92.

**Table.19 AIOS correlation with SpO2 reading**

| SpO2reading(%) | AIOS score on day1 | | | | | |
|---|---|---|---|---|---|---|
| | ≤10 | | 11-15 | | ≥16 | |
| | n | % | n | % | n | % |
| <85 | 1 | 7.1 | 0 | 0 | 13 | 92.9 |
| 85-92 | 38 | 38.4 | 25 | 25.3 | 36 | 36.4 |
| >92 | 110 | 81.5 | 16 | 11.9 | 9 | 6.7 |

**$\chi 2=85.4$ P=0.001**

## 9. AIOS score and investigations

74.6% (85/114) children with normal CXR had AIOS of ≤10 whereas only 47.8 %( 64/) had normal scores in the group of abnormal CXR finding ($\chi 2=29.1$ P=0.001). Total leucocytes count, urine and blood culture were done in all patients to find out illness severity. Culture positivity in urine and blood cultures as well as an elevated leucocytes

count was seen in maximum percentage in children scoring >15 in AIOS scale which was statistically significant.

**Table.20 AIOS correlation with investigations**

| investigations | | AIOS score on day 1 | | | | | | Chi square test |
|---|---|---|---|---|---|---|---|---|
| | | ≤10 | | 11-15 | | ≥16 | | |
| | | n | % | n | % | n | % | |
| Chest X ray | abnormal | 64 | 47.8 | 21 | 15.7 | 49 | 36.6 | $\chi 2=29.1$ P=0.001 |
| | normal | 85 | 74.6 | 20 | 17.5 | 9 | 7.9 | |
| X ray Finding | consolidation | 8 | 15.1 | 11 | 20.8 | 34 | 64.2 | $\chi 2=38.5$ P=0.001 |
| | infiltrates | 55 | 68.8 | 10 | 12.5 | 15 | 18.8 | |
| Leucocytosis | | 5 | 14.7 | 5 | 14.7 | 24 | 70.6 | $\chi 2=51.2$ P=0.001 |
| Positive Blood culture | | 0 | 0 | 3 | 8.8 | 31 | 91.2 | $\chi 2=102.2$ P=0.001 |
| Positive Urine culture | | 4 | 13.3 | 5 | 16.7 | 21 | 70.0 | $\chi 2=44.1$ P=0.001 |

## 10. AIOS score and therapeutic decision

Univariate analysis was done to know the relationship of AIOS with therapeutic decision, except for salbutamol nebulization all other therapeutic modalities were significantly related to initial AIOS score (p=0.001)

**Table.21 univariate analysis of AIOS with therapeutic decision**

| Therapeutic decision(n) | | AIOS_Day1 | | | Statistical significance |
|---|---|---|---|---|---|
| | | ≤10 | 11-15 | ≥16 | |
| | | n ( %) | n (%) | n (%) | |
| antibiotic | Oral(123) | 114 (92.7%) | 8 (6.5%) | 1 (0.8%) | $\chi 2$=111.9 P=0.001 |
| | I.V(125) | 35 (28.0%) | 33 (26.4%) | 57 (45.6%) | |
| IV fluid received(71) | | 3 (4.2%) | 15 (21.1%) | 53 (74.6%) | $\chi 2$=164.0 P=0.001 |
| Normal saline bolus(21) | | 0 (0%) | 0 (0 %) | 21 (100.0%) | $\chi 2$=75.2 P=0.001 |
| Ionotropes(19) | | 0 (0%) | 0 (0%) | 19 (100.0%) | $\chi 2$=67.4P=0.001 |
| Ventilation (7) | | 0 (0%) | 0 (0%) | 7 (100.0%) | $\chi 2$=23.5 P=0.001 |
| Oxygen(80) | | 5 (6.3%) | 22 (27.5%) | 53 (66.3%) | $\chi 2$=158.3 P=0.001 |
| Nebulisation(63) | | 35 (55.6%) | 16 (25.4%) | 12 (19.0%) | $\chi 2$=4.98 P=0.08 NS |
| Intercostals drainage(9) | | 0 (0%) | 4 (44.4%) | 5 (55.6%) | $\chi 2$=14.1 P=0.001 |
| decortications(3) | | 0 (0%) | 3 (100.0%) | 0 (0%) | $\chi 2$=15.3 P=0.001 |

**Comparison of AIOS with IMNCI in illness severity assessment and clinical outcome in pneumonia**

**1. Illness severity assessment**

Comparing AIOS with IMNCI in assessing illness severity of pneumonia , among the 73 cases of pneumonia 95.9% cases scored normal

on AIOS (AIOS<10),whereas in 56 cases of very severe disease 80.4%(45)cases scored abnormally.

**Table.22 comparison of AIOS with IMNCI in illness severity assessment**

| IMNCI | AIOS_Day1 | | | | | |
|---|---|---|---|---|---|---|
| | ≤10 | | 11-15 | | ≥16 | |
| | n | % | n | % | n | % |
| Pneumonia(73) | 70 | 95.9% | 2 | 2.7% | 1 | 1.4% |
| Severe pneumonia(119) | 76 | 63.9% | 31 | 26.1% | 12 | 10.1% |
| Very severe pneumonia(56) | 3 | 5.4% | 8 | 14.3% | 45 | 80.4% |

**$\chi 2$=160.72 P=0.001**

Comparing with IMNCI sensitivity of AIOS in detecting illness severity in pneumonia was very high (95%) but with a poor specificity (55%), where as in very severe pneumonia its sensitivity was poor (48%) but had very high specificity (98%). In case of severe pneumonia both sensitivity and specificity of AIOS score was very poor

**Table.23 sensitivity and specificity of AIOS**

| IMNCI | AIOS | | |
|---|---|---|---|
| | sensitivity | specificity | accuracy |
| pneumonia | 95%(88-99) | 55%(47-62) | 67%(60-72) |
| severe pneumonia | 51%(43-59) | 57%(46-57) | 53%(47-60) |
| very severe pneumonia | 48%(39-58) | 98%(94-100) | 77%(72-82) |

## 2. Clinical outcome

### Persistent distress on day5

Among the 148 who scored AIOS<10 only 2.02% had mild – moderate distress persisting on day5, while out of the 41 who scored 11-55 on AIOS 7.31% had mild –moderate distress persisting. In the worst group of AIOS score, out of the 54 cases 3.7%had severe retraction and 33.3% had mild to moderate distress persisting on day5

**Table.24 AIOS in predicting persistent distress on day5**

| AIOS | | Persistent distress on day 5 | | | total | Chi-square test |
|---|---|---|---|---|---|---|
| | | no | Mild-moderate | severe | | |
| ≤10 | n | 145 | 3 | 0 | 148 | |
| | % | 97.97 | 2.02 | 0 | | |
| 11-15 | N | 38 | 3 | 0 | 41 | $\chi 2=98.6$ P=0.001 |
| | % | 92.68 | 7.31 | 0 | | |
| ≥16 | N | 34 | 18 | 2 | 54 | |
| | % | 62.96 | 33.33 | 3.70 | | |

In the IMNCI classification of respiratory illness, among the pneumonia cases none had persistent distress on day5. In the severe pneumonia group 4.4% had mild-moderate distress and only 0.6% had severe persistent distress. In the very severe pneumonia group 33.3% had mild to moderate distress and 2% had severe distress persisting on day5

**Table.25 IMNCI in predicting persistent distress on day 5**

| IMNCI | Persistent distress on day5 | | | | | | Chi-square test |
|---|---|---|---|---|---|---|---|
| | no | | Mild-moderate | | severe | | |
| | n | % | n | % | n | % | |
| Pneumonia(33) | 33 | 100% | | | | | $\chi 2$=42.09 p=0.001 significant |
| Severe pneumonia(159) | 151 | 95.0% | 7 | 4.4% | 1 | 0.6% | |
| Very severe pneumonia(56) | 33 | 64.7% | 17 | 33.3% | 1 | 2.0% | |

**Complications**

Complications were absent in those who scored <10, while maximum complications were seen in those who scored >15. Similarly in the IMNCI classification complications were absent in pneumonia cases and maximum in very severe pneumonia cases

**Table.26 AIOS in predicting complications**

| AIOS | | complications | | total | Chi square test |
|---|---|---|---|---|---|
| | | present | absent | | |
| ≤10 | N | 0 | 150 | 150 | $\chi 2$=84.1 P=0.001 |
| | % | 0 | 100 | | |
| 11-15 | N | 4 | 37 | 41 | |
| | % | 9.75 | 90.24 | | |
| ≥16 | N | 20 | 37 | 57 | |
| | % | 35.08 | 64.91 | | |

**Table.27 IMNCI in predicting complications**

| IMNCI | complications | | | | n | Chisquaretest |
|---|---|---|---|---|---|---|
| | present | | absent | | | |
| | n | % | n | % | | |
| pneumonia | 0 | 0 | 34 | 100 | 34 | $\chi 2=73.95$ p=0.001 significant |
| Severe pneumonia | 5 | 3.1 | 154 | 96.9 | 159 | |
| Very severe pneumonia | 19 | 34.5 | 36 | 65.% | 55 | |
| **Table Total** | **28** | **9.7** | **223** | **90.3** | **248** | |

**Hospital stay**

Out of the 149 who scored <10 on AIOS 95.3% had a hospital stay of <5 days, while those scored the worst 48.3% had a stay duration of 6-14 days and 20.7% had >14 days hospital stay duration. In the IMNCI groups hospital stay was more prolonged in very severe and severe pneumonia groups

**Table.28 AIOS in predicting duration of hospital stay**

| AIOS | | Duration of hospital stay (in days) | | | total | Chi square test |
|---|---|---|---|---|---|---|
| | | ≤5 | 6-14 | >14 | | |
| ≤10 | n | 142 | 6 | 1 | 149 | $\chi 2=46.7$ P=0.001 |
| | % | 95.30 | 4.02 | 0.67 | | |
| 11-15 | N | 31 | 8 | 2 | 41 | |
| | % | 75.60 | 19.51 | 4.87 | | |
| ≥16 | N | 18 | 28 | 12 | 58 | |
| | % | 31.03 | 48.27 | 20.68 | | |

**Table.29 IMNCI in predicting duration of hospital stay**

| IMNCI | hospital stay | | | | | | n | % |
|---|---|---|---|---|---|---|---|---|
| | <=5 days | | 6 -14 days | | >14 days | | | |
| | n | % | n | % | n | % | | |
| pneumonia | 32 | 97.0% | 1 | 3.0% | | | 33 | $\chi 2$=65.05 p=0.001 significant |
| Severe pneumonia | 138 | 86.8% | 15 | 9.4% | 6 | 3.8% | 159 | |
| Very severe pneumonia | 21 | 37.5% | 26 | 46.4% | 9 | 16.1% | 56 | |

**Final outcome**

Regarding the final outcome death was seen only in those who scored >15 on AIOS (8.62%). Similarly IMNCI also predicted death in very severe disease.

**Table.30 AIOS in predicting final outcome**

| AIOS | | Final outcome | | total | Chi square test |
|---|---|---|---|---|---|
| | | died | discharged | | |
| ≤10 | n | 0 | 149 | 149 | $\chi 2$=16.71 P=0.001 |
| | % | 0 | 100 | | |
| 11-15 | N | 0 | 41 | 41 | |
| | % | 0 | 100 | | |
| ≥16 | N | 5 | 53 | 58 | |
| | % | 8.62 | 91.37 | | |

**Table.31 IMNCI in predicting final outcome**

| IMNCI | Final outcome | | | | Chi square test |
|---|---|---|---|---|---|
| | died | | discharged | | |
| | n | % | n | % | |
| Pneumonia(33) | | | 33 | 100.0% | $\chi 2=17.49$ p=0.001 significant |
| Severe pneumonia(159) | | | 159 | 100.0% | |
| Very severe pneumonia(56) | 5 | 8.9% | 51 | 91.1% | |

# DISCUSSION

Childhood pneumonia clearly represents one of the most common infective illnesses in developing countries and is of great importance as a cause of preventable mortality in children. To attack this global problem, WHO shaped strategy for effective case management that had remarkable impact on mortality due to childhood pneumonia in developing countries. Most of the presenting symptoms in young infants and children may be associated with different illness or more than one illness. Therefore for early detection and prompt treatment of illness there is need for an effective strategy that target children less than 5 years old, the age group that bears highest burden on death. This has been aided by the IMNCI strategy that simplifies the classification of illness severity for major acute childhood illness including pneumonia.

IMNCI strategy will be more effective in managing pneumonia when supplemented by an illness severity scoring system delivered in the context to primary care setting that can quantity quickly the severity of illness at all stages from onset to recovery. The present study was done with this view in mind. The objective of this study was to validate AIOS

score in community acquired pneumonia in assessing illness severity and clinical outcome.

The compromised general status entailing various observation variables of AIOS had already shown to be significant and independent predictor of serious illnesses. Being a subjective score inter observer variation in scoring was analyzed using Karl Pearson correlation and was found to be having high positive correlation.

Validating the score in illness severity assessment in pneumonia, it was found that the scoring is having good sensitivity but with a poor specificity in pneumonia and in severe pneumonia it had a good specificity but a poor sensitivity. In severe pneumonia it had a poor sensitivity and specificity in diagnosing pneumonia compared to IMNCI. So IMNCI is still the superior sensitive tool in classification of pneumonia. Though the internal consistency and external validity of AIOS scoring system is very high as proven by our study its utility as a sensitive tool in diagnosing severe illnesses should be restricted to those presenting with febrile illness that present without any focus of infection.

This study has brought out the fact that AIOS scoring has a good correlation with initial pulse oxymetre reading and decision regarding

supplementation of oxygen. So it can be used as a tool to decide on providing oxygen to patients in resource limited areas.

AIOS scoring also had a good correlation with X ray abnormalities so can be utilized to decide on x ray evaluation and preventing unnecessary exposure to harmful radiations in a child with pneumonia.

AIOS also correlated well with initial therapeutic decision like route of antibiotics, need for intravenous fluid administration and other modalities, so can be used for the same purpose in a hospital

Comparing the ability of AIOS score to predict clinical outcome with that of IMNCI both were found to be more or less equally predictive. Regarding the persistence of respiratory distress on day 5 of hospital stay severe distress was present in 3.7% of those children scored AIOS≥16 and in IMNCI very severe pneumonia group 2% had same finding and both of them were statistically significant.

Similarly on predicting complications maximum numbers of complications were present in those with AIOS score ≥16 (35%) and in very severe group in IMNCI (34.5%) which were almost equal.

Both IMNCI and AIOS predicted the length of hospital stay in a similar manner with maximum duration of stay in those with a worst AIOS score and very severe illness.

Regarding final out-come all the deaths occurred in the worst AIOS score group (8.6%) and in the very severe pneumonia group in IMNCI (8.9%) which were also similar.

Though AIOS can predict clinical outcome in children with pneumonia it is not superior to IMNCI in same regards. AIOS scoring is usually done by a skilled physician familiar with behavior of a child in varying degrees of illness severity in the hospital setting where as IMNCI classification of pneumonia is done by peripheral health workers in the field setting. So AIOS scoring can be used by the treating physician in deciding on therapeutic modalities and prognosticating a child admitted to the hospital with pneumonia.

# SUMMARY AND CONCLUSIONS

- AIOS scoring has good internal consistency and external validity.
- Inter observer agreement between two observers in AIOS scoring is very good.
- AIOS scoring cannot be used as a sensitive tool to classify illness severity in pneumonia.
- IMNCI remains the more sensitive tool in illness severity classification in pneumonia.
- AIOS correlates well with abnormal X ray findings and other investigations and therapeutic decision taken by the physician.
- AIOS has good correlation with initial SpO2 reading.
- Both IMNCI and AIOS predict clinical outcome similarly in community acquired pneumonia.
- IMNCI can be used as a tool to triage and early referral of children with community acquired pneumonia in the fields by peripheral health care workers.
- AIOS can be used as a tool to decide on therapeutic modalities and prognosticating a child with pneumonia admitted to the hospital by a physician

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# ANNEXURE

## DATA COLLECTION FORM

Name: DOA:

IP NO:

Age: DOD:

weight:

Sex:

**Complaints with duration**

Fever

Cough

Rapid/difficult breathing

Convulsion

Inability to drink

Lethargy

Grunt

**Signs**

| parameters | Day1 | Day2 | Day5 |
|---|---|---|---|
| Respiratory rate | | | |
| Temperature | | | |
| Heart rate | | | |
| Blood pressure | | | |
| Capillary refill time | | | |
| lethargy | | | |
| Cyanosis | | | |
| Grunting | | | |
| Stridor | | | |

| | | | |
|---|---|---|---|
| Retraction | | | |
| Intercostals | | | |
| Sub costal | | | |
| Mild-moderate | | | |
| Severe | | | |
| Breath sounds | | | |
| Bronchial breathing | | | |
| Crackles | | | |
| Vocal resonance | | | |
| Wheeze | | | |
| IMNCI class | | | |
| SpO2 reading | | | |
| AIOS scoring | | | |

Radiological findings: present/absent

Type: end point consolidation/non end point infiltrates

CBC

Other investigations: urine c/s NEC

Treatment given: antibiotic- oral/i.v oxygen i.v fluids others

Complications

## ACUTE ILLNESS OBSERVATION SCALE

| **observation item** | **normal (=1)** | **moderate impairment (=3)** | **severe impair (=5)** | D1 | D2 | D5 |
|---|---|---|---|---|---|---|
| 1.quality of cry | strong with normal crying | Whimpering or sobbing and not crying | Weak or moaning Or high-pitched | | | |
| 2. Reaction to Parent Stimulation (effect on crying When Held, patted on back Jiggled on lap, or Carried) | Cries briefly, Then stops Or Content and Not crying | Cries off And on | Continual cry Or Hardly respond | | | |
| 3.State Variation (going from awake To asleep or asleep To awake) | If awake, then Stays awake Or If asleep and Stimulated, then Wakes up quickly. | Eyes-close Briefly, Then awakens Or Awakens with, Prolonged Stimulation | Will not rouse Or Falls to sleep | | | |
| 4. Color | Pink | Pale hands, Feet Or Acrocyanosis | Pale Or Blue Or Ashen (gray) Or Mottled | | | |
| 5. Hydration (moisture in Skin, eyes, mouth) | Skin normal And Eyes, Mouth moist | Skin, eyes Normal; And mouth slightly Dry | Skin doughy Or tented And Eyes may be sunken And Dry eyes and mouth | | | |
| 6. Response To social overtures | Smiles Or Alerts ( 2 months or Less) | Brief smile Or Alerts briefly (2 months or Less) | No smile, Face anxious Or Dull Expressionless Or No Alerting(2 Months or Less) | | | |